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ABSTRACT

Lifelong learning through a strong, policy-supported information technology (IT) infrastructure is critical to the success of Asia Pacific Economic Cooperation (APEC) member economies. There is a great need to upgrade the quality of skills within the workforce, and there have been unprecedented investments in infrastructure and advanced technology. Quality, productivity, and innovation are required in a competitive environment, and can be established through lifelong learning. Singapore, Chinese Taipei, and Malaysia have all developed new approaches to workforce learning, either through increased technical training in conjunction with industry, or through the establishment of multimedia educational facilities. Canada is developing an infrastructure that will facilitate long term access to learning opportunities. Initiatives include: (1) The Information Highway Advisory Council, which creates jobs and universal access to the Internet; (2) The Canadian Network for the Advancement of Research, Industry and Education, which facilitates communications structure; (3) SchoolNet, which enhances educational opportunities; and (4) Health Iway, which provides health services across the country. Those who may be negatively affected by the initiative are rural workers, women, minorities, and blue collar workers if it reinforces existing workforce inequalities. However, through the use of partnership, technology, infrastructure development, and operative programming, the common goal of a lifelong education may be met. (YKH)

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Lifelong Learning, Workforce Development and Economic Success

by Alice Lee

From Singapore's "Total Business Centre", designed to attract international business investment to help support plans for intensive and ongoing workforce retraining, to Canada's CANARIE project, designed to link the efforts of government, industry, and education in a coordinated response to workforce development needs, APEC member economies have developed different approaches for responding to the evolution of information technology and the need for lifelong learning. This paper describes the environment within the APEC region that is creating pressure for workforce development and lifelong learning, discusses examples of various infrastructure activities intended to support the formation of a learning society, and identifies key strategies common to the development of a lifelong learning culture.

INTRODUCTION

Lifelong learning is a broad, conceptual term which is used to describe the process of continuous learning, personal enrichment and extension of knowledge that takes place over the course of the human lifespan. Learning, as the prime sub-component, presupposes a process of self-directed, though perhaps economically driven, exploration and discovery of knowledge, skills and abilities. Included in the lifelong learning concept are formal, non-formal, and informal experiences, such as schooling, on-the-job training, learning by doing, and all other everyday forms of experience. In effect, to live is to learn.

Dramatic advances in technology, spiralling economic competition, and increasing global trade are changing the world at a dizzying pace. Linked to these changes is the need for increased and ongoing self-directed and self-driven learning in order for people and systems to respond and adapt to the changing world. The key challenge facing all societies is to develop and implement effective ways for citizens to maximize their learning potential throughout the lifespan.

This paper argues that lifelong learning is critical to the success of APEC and its member economies and details ventures which verify that there is a host of new learning initiatives underway which are marked by innovation, variety and distinctiveness from the traditional educational establishment. Further, this paper exploits the view that lifelong learning for the 21st century requires a strong, policy-supported, information technology (IT) infrastructure. Concrete examples of how

selected APEC members, and particularly Canada, are developing such structures are described.

APEC AND THE ENVIRONMENT

APEC is an eighteen member economic forum with a population exceeding two billion. The members are geographically distant, culturally distinct and economically different. The region as a whole is characterized by strong and continuing economic growth (see Economic Committee, 1996), and all APEC members embrace the notion that human capital formation and investment in people are key determinants in achieving sustainable economic growth. Within East Asia, the average annual economic growth has been particularly strong and is predicted to average more than 8% during 1997 (Economic Committee, 1996, p. 4). Although the broad APEC market has tremendous growth potential, it is important to note that the region faces enormous productivity and technology variances resulting in significant measure from the fact that APEC members reflect a broad range of economic development stages.

The globalization of economic activity is related to several factors, including free market policies, increasing cross-ownership, escalating labour mobility, and the freer flow of capital. Economies are being linked without regard to national boundaries, if not by design then by market factors. Further, technological advances have, during the past decade in particular, combined with broad economic integration to speed the development of the global economy. The result is increased and increasing competition. In order to survive, and indeed profit, in the global economy, workers in the new order need to be educated, re-educated and educated again. A carefully designed and comprehensive program of learning opportunities, which encompasses a developed structure for learning at all levels in all places at all times throughout the lifespan, has become crucial in order to prepare the workforce of the future.

Skills and knowledge are the basis for higher wage employment and economic competitiveness. The combination of technological advances and the processes associated with the ever widening integration of the global economy have made it necessary for workers to acquire new skills throughout the lifespan. Innovation, freer trade, and technology are driving educational change, while changes in employment opportunities and living standards are byproducts. Particularly within the Asian APEC economies, newly industrialized and industrializing members are moving, or desperately trying to move, from low technology, labour intensive production into more technologically advanced activities.

The overall environment is characterised by three key opportunities and challenges:

- there continues to be an unrelenting need to upgrade the quality of skills within the workforce in order to maintain international competitiveness;
- there will be unprecedented investment in infrastructure and advanced information technology including telecommunications within the region (Asian members will spend in excess of US$1 trillion on infrastructure during the next

decade - see *APEC: Opening Doors for Canadian Business*);

- there are significant risks associated with the fact that rapid development and advances are increasing the gap between the rich and poor, and that certain disadvantaged groups may be increasingly marginalized and unable to compete in the new environment.

Learning and education are central to both the opportunities and the challenges.

PRESSURES TO UPGRADE THE WORKFORCE

The shift from a low skilled labour market orientation towards highly skilled knowledge workers is growing at a dramatic rate in many economies. Hong Kong and Chinese Taipei are examples of this trend. Three decades earlier, these economies were characterized by low level technical production and manufacturing. Now, Hong Kong has established itself as a centre for business and finance, developing plants and production activities in the P.R.C. During this same period Chinese Taipei has generated an enviable reputation in the field of information technology, both in manufacturing and in research and development.

In effect, the escalating race throughout the region to the higher end of the production and service delivery continuum is requiring a new workforce, one that is highly trained, flexible and not only open to re-training throughout the lifespan but actually seeks it out and embraces it. A further consequence of the demand for a workforce that embodies greater effectiveness and more efficient use of resources is the search for alternatives to the existing educational structures, programs and delivery methods. What is needed, and needed now, are learning alternatives that provide quicker and more targeted skills and knowledge development within the workforce, and all this at an increasingly higher level of technical sophistication.

The 21st century will see rising demand from employers for highly skilled employees, and unless the educational qualifications of the labour force are upgraded as fast as the shift in demand for labour, inequality and disparities will widen. In effect, the argument made here is that a lifelong learning system can be the solution for inequality within an economy and perhaps within the region. Conversely, without an effective lifelong learning system, the distance between the have and have-not members of the societies will not only widen, but may in fact become so distant as to become irrecoverable.

Acquiring and maintaining a competitive advantage is directly linked to the knowledge and skills of employees. Ongoing learning is the key to organizational versatility, adaptability and overall effectiveness. Three factors become extremely important in a highly competitive environment:

- quality, because consumers, particularly as they grow wealthier, tend to invest in products that provide the greatest value;
- productivity, because, to remain productive, producers must provide goods and services that parallel demand, on time and at a favourable cost;
- innovation, because the creative application of resources makes producers more responsive to consumer needs.

The relationship between the development of human capital and economic growth is especially well illustrated within the East Asian region. Specifically, there is strong evidence of this link in Hong Kong and Chinese Taipei, as described earlier, in Japan, Korea, and Singapore, and to a lesser extent and more recently in Malaysia and Thailand. The transition from labour intensive industries to knowledge-based ones in less than a generation can be attributed in substantial measure to education and training, along with hard work. System-wide planning and certain cultural traits have also supported this transition.

Not surprisingly, the diversity of comparative advantages in Asia has been reflected in the structure of exports from this region. The least developed economies were more dependent on exports of primary products and low-end manufacturing. However, as economies developed, exports shifted to include more finished products. At this same time, many of these economies, including Singapore and Chinese Taipei, faced increased labour and materials costs, and were forced to re-examine tactics for growth and competitiveness. Large investments in infrastructure, such as research institutes, allowed them to become generators and exporters of knowledge-based products and services, as in the examples of Singapore and Chinese Taipei. Within the past decade these economies have invested beyond their borders, shifting labour intensive manufacturing into southeast Asia and the P.R.C.

Perhaps most pertinent in the overall context of this discussion is the fact that the system of education and training implemented and developed in the fast-growing Asian economies during the past few decades has been significant but at the same time quite traditional. Included has been an emphasis on in-school learning, differentiated vocational and academic streams, and a highly competitive environment. Mass education has not meant similar opportunities for all. Rather, educational structures have produced the type of workers in more or less suitable quantities for the current stage of economic development and regional competition. Now, there is a need for a new paradigm. Lifelong learning is not simply more learning, nor is it simply learning at a higher level. Lifelong learning incorporates the development of a learning culture, something that schools and educational systems have in the past failed to achieve. What we are seeing now is the evolution of new learning paradigms.

NEW APPROACHES TO WORKFORCE LEARNING

This section of the paper details several Asian examples of new and widely differing approaches which are being set in motion in order to construct and develop much needed lifelong learning communities.

Singapore

The labour shortages of the mid-1970s in Singapore led to the development of technology intensive manufacturing industries. Concurrently, there was a renewed emphasis on technical education and training as well as expanded incentives for more research and development. In the 1980s, the government determined to develop knowledge intensive industries which, in turn, led to the current focus on IT,

aerospace technology, pharmaceutical products, and computer aided design and computer aided manufacturing (CAD/CAM).

With its high labour costs, Singapore focused on a "Total Business Centre" strategy, whereby tax reductions and exemptions were given to foreign companies that established comprehensive operations within the economy. Another strategy was to continually upgrade the skills of the workforce, the Institute for Technical Education and the polytechnics being the driving force for much of this, along with increasing R&D incentives. Singapore expects to gain competitive advantage by becoming an electronic society, but the workforce issue must be continually addressed. In what may turn out to be a simple yet extremely effective strategy, Singapore is developing a product known as the Students' Multimedia Integrated Learning Environment, or SMILE (Smile ..., 1996). Launched in early 1996, this effort integrates the expertise Singapore wants to develop and become known for, with an applied solution that will be used to develop the workforce needed to support the product. The end has become the means.

Rather than relying purely on the traditional education system to drive this initiative, it is driven by collaboration between Informatics Holdings Limited and Singapore's National Computer Board's Information Technology Institute. In Singapore, the notion of involving business and industry in workforce training has always been very strong. In this case, however, it is taken to a new level. Business and industry is not simply going to be the curriculum focus, it is going to be much of the development and delivery mechanism as well. This is quite a departure when compared with educational systems where the private sector may be involved, or at least appear to be involved, in curriculum decisions but the delivery continues to remain almost entirely in teacher-centred educational institutions. Singapore intends to turn the paradigm around and become a leader in the development and export of IT-enhanced learning technology. Given Singapore's previous record of successes in planned development, APEC members would be well advised to pay close attention to this initiative.

Chinese Taipei

In little more than a decade Chinese Taipei has established itself as a leading centre for higher technology research and development, and for IT training. It did this through several strategies, key among them was the development of the Hsinchu Science-Based Industrial Park (SIPA) in 1980. Since the time of its establishment, this enclave has developed a world-wide reputation as an IT research and learning community, and has attracted a host of high profile companies that includes Acer Computer, United Microelectronics Corp., and Texas Instruments-Acer Inc. State-of-the-art infrastructure, a host of government incentives, R&D grants, and close proximity to air and sea ports, made Hsinchu a success in so far as attracting higher technology companies.

More importantly, at Hsinchu it has been the synergy of companies and personnel on site that have, in turn, attracted more human resources in order to build the learning community. Success begets success. From the earliest stages, every effort was made to incorporate technical training alongside the research and development

activities, and as of this date, for example, more than 1,000 US-trained engineers have been attracted to the park because of the working and learning opportunities it provides (Spotlight on Success, 1996). The private sector, government and not-for-profit foundations, along with innovative universities and research institutes, have formed creative research, training and production relationships at Hsinchu that support integrated lifelong learning (see Hatton, 1995, pp. 73-76). At this stage, the human resource base at Hsinchu is the foundation for one of the most successful IT learning communities in the world. Working and learning have become synonymous.

Currently, Chinese Taipei is developing a new site along similar lines in the south near Kaoshiung. Though in the early stages of development, this is planned implementation of the broader concept which is designed to turn Chinese Taipei into an island of intelligent industrial parks. Clearly, lifelong learning is an inherent part of the design, and a component which feeds on itself to build further success.

Malaysia

Malaysia is chasing some of the region's more developed economies with its economic development plan titled *Vision 2020* (see Ahmad Sarji Abudl Hamid, 1993). The goal of this plan is to position Malaysia as a developed economy through productivity-led growth by the year 2020.

One element in the overall plan, to be developed over the course of the next two decades, is the formation of a Multimedia Super Corridor (MSC). The MSC pictures Malaysia as an island of excellence in technology, infrastructure, legislation and policies. Leading to this will be the formation of an electronic government, universities, research and development centres, tele-medicine centres, and high speed road and rail links. The government has created the Multimedia Development Corporation to manage and market the Multimedia Super Corridor. This plan and the success to date contrasts with economies where merely maintaining current roads appears to be stretching resources to their limits.

In order to upgrade skills development and management training, Malaysia currently has 60,000 students studying at colleges and universities overseas as it redevelops its education and training at home. As well, Malaysia is partnering with world centres of excellence in a variety of technical areas and Smart Cities. A new Multimedia University, scheduled for completion in the fall of 1997, will be geared to meet the specific needs of the information technology industry.

Underlying *Vision 2020* and the MSC is the development of the workforce and a concomitant lifelong learning ethic in the context of technical and vocational education within Malaysia. In fact, it could be said that *Vision 2020* and the MSC are simply the carrots which are designed to draw resources which will support ongoing workforce development. Whatever the case, it is clear that Malaysia is committed to the creation of a learning culture, and the goals do not focus on today's needs but rather they anticipate the future and are actively positioning the economy and the workforce. Contrast this with economies where there is no agreement on a national plan, let alone the activities to implement it.

CONVERGENCE, EDUCATION AND CANADA

Advancements in communications technology are leading to a convergence of computers, telephones, televisions, fax machines, video cameras, and satellites. This is affecting the way people around the world work, shop, bank, communicate and entertain. The influence of new technology on education has at this stage been more rhetoric than action, but this will soon change. New technologies when applied to learning will vastly improve access to resources and information, provide differential responses to specific learning needs, and better share scarce resources. Technology may also directly affect our internal capability to receive, digest and use knowledge.

In education, there is much detailed speculation about the influence of technology, specifically on distance education, as well as the influence of new learning technologies on the traditional teaching and learning model. The Internet and World Wide Web, in particular, appear to present opportunities that will challenge the very nature of education, or learning, and forever alter an establishment that has long enjoyed a monopoly on much of the learning environment. Very soon, the *information consumer* will have the potential to force a shift away from the classroom setting and into a *virtual learning environment*. Learners will soon demand learning opportunities regardless of where and who they are, and the competition will be notable.

Critical to the development of effective lifelong learning opportunities in a world of convergence is the establishment and maintenance of a "climate" or infrastructure for advanced information technology and telecommunications. Technology is a powerful engine for driving the development of new learning opportunities, but it is critical that the proper foundation and environment be established at a national level. With regard to education in Canada, the information highway is a work in progress. It promises, but has not yet delivered, a means for providing more practical, more varied, less expensive and enormously better learning opportunities. Canada continues to be concerned with the development of an infrastructure to support the information highway and specific strategies are being developed in recognition of the fact that a well developed infrastructure will facilitate better long term access to learning opportunities.

In this regard, the Canadian Jobs and Growth Agenda has been developed in order to increase productivity by encouraging growth. It focuses on three areas: youth, technology, and trade. In turn, these reflect lifelong learning, technology and APEC. In effect, the Jobs and Growth Agenda is a national plan to create an infrastructure for lifelong learning that will support the development of a comprehensive, competitive, highly skilled workforce beyond 2010. In this plan certain initiatives are being implemented which will exploit and develop the lifelong learning foundation. What follows is a brief summary of four examples.

Information Highway Advisory Council

The Canadian Information Highway Advisory Council was established in 1994 by John Manley, Canada's Minister of Industry. Broadly speaking, its purpose is to cre-

ate jobs through innovation and investment, reinforce Canadian identity, and ensure *universal access* to the Internet and other information technology at reasonable cost. The operating principles under which the Council functions include lifelong learning as a key design element in Canada's information highway (Information Highway Advisory Council, 1996).

The Council debates a variety of public policy issues that have the potential to affect how innovation, investment and access to communications technology in Canada will occur. These include how fast information networks should be built, the balance between competition and regulation, control of communication networks, standards, federal and provincial coordination, control or censorship of information, privacy, consumer awareness, and the potential for affecting government activities. On a broad scale, the Information Highway Advisory Council is developing policy related to the development of the technology that will support the growth of a lifelong learning culture. The Council has stated that "if Canadians are to compete effectively on the global Information Highway, they need to embrace learning ..." (Information Highway Advisory Council, 1996, p. 2). Perhaps better than any other policy body in Canada, the Council reflects a concerted effort on the part of the Canadian Government to develop national policy and structure directly related to lifelong learning opportunities in the broadest context.

Canadian Network for the Advancement of Research, Industry and Education

In Canada, beyond the work of the Information Highway Advisory Council, the need for the development of an IT infrastructure which will further support the evolution of a lifelong learning environment has led to the creation of partnerships that include government, business, educators, and researchers. One of the key initiatives undertaken to foster the growth of these partnerships has been the formation of the Canadian Network for the Advancement of Research, Industry and Education (CANARIE). This is a not-for-profit organization with 140 members from industry and the research and education communities.

CANARIE's mission is to accelerate the emergence of Canada's Information Society (CANARIE, 1996). This includes the facilitation and development of Canada's communications structure and the development within Canada of next-generation advanced IT network products and applications. Unlike many other forms of government support, CANARIE's Technology and Applications Development (TAD) specifically targets for-profit corporations. Financial support from CANARIE for research and development projects can be as high as 50% of eligible project costs, though the average is approximately 30%. Emphasis is placed on projects which will likely lead to commercial success, and which involve more than one for-profit contractor. CANARIE shares in the commercial success of funded ventures through royalty agreements. In effect, CANARIE is an independent, though government funded body which supports private sector IT research projects and development activities that have demonstrable likelihood for commercial success. In this way, CANARIE is a policy implementation body designed to promote the development of in-Canada tools that will support the development of critical IT applications.

SchoolNet

The objective of the SchoolNet Program is to broadly enhance educational opportunities in Canadian schools by linking them electronically and making national and international resources available to all users. From the public's perspective, it is one of the most transparent examples of Canada's attempts to build a lifelong learning technology-based infrastructure.

In Canada, education is a provincial responsibility and the SchoolNet project, therefore, involves provincial and territorial governments, elementary and secondary schools, post-secondary institutions, and private industry. Currently, there are more than forty public and private sector partners involved with SchoolNet. Ultimately, this program is expected to provide the infrastructure for student and teacher interaction without regard to location or time. For students groomed in this system, it could provide the basis for individualized learning throughout the lifespan.

By 1998, SchoolNet is expected to link 6.5 million elementary and secondary students through 16,500 schools and 3,400 libraries. Rural students will have access to the same resources as those in urban areas, a major development in educational opportunities within an economy marked by large rural expanses and, in some cases, hundred of kilometres separating communities. In addition, the SchoolNet Community Access Project will provide up to 1,000 rural communities with access to the information highway, including the 400 aboriginal schools which fall under federal jurisdiction. Completion of this project will position Canada as the first country in the world to connect all of its schools to the information highway.

Health Iway

The Canadian Health Iway is a technical framework designed to provide network-based health services across the country. For Canada, this is a critical issue. Canada's geography is such that the delivery of health care to all its citizens is difficult, particularly in the case of those who live in northern and rural areas. This is exacerbated by the fact that people in Canada are living longer, as is the case with many other APEC economies, and the cohort of older citizens is growing larger both in terms of actual numbers and as a percentage of the total population. The so-called "baby boomer" generation, which is the bubble cohort born in the wake of World War II, is adding to the dynamic. Almost three decades ago, Canada committed itself to a government funded national health care system. Now, in the context of the issues just noted, that system may be in jeopardy. Technology and lifelong learning have the potential to provide a partial solution.

With Health Iway there is a strong technical emphasis. The program is based on network architecture; sender, receiver, and carrier capabilities; operational hardware and software; user training and support services; health information technology; and telecommunication products. However, more important is the relationship to education and lifelong learning in particular. Lifelong learning, as described in the introduction to this paper, is a broad conceptual term that includes all learning relevant for personal and professional benefits. In the past, health care was primarily a mat-

ter for specialists, individuals did relatively little to manage their own care and the costs reflected this. In the future, there will be increasing need for individuals to manage their own health, both when they are healthy and when they are not. Health Iway is a tool for developing and supporting this. It will provide continual learning opportunities through health education services, health databases, and screening tools, all of which are integral elements for Canada's lifelong learning network in the 21st century.

EQUITY AND DISPARITIES

Noted earlier in this paper is the potential for reinforcing existing workforce inequalities and, potentially, making them larger. This is an issue facing all economies that are focusing on workforce-upgrading as they attempt to stimulate economic growth and prepare for increasing regional if not global competition.

In newly developing economies, this issue of increasing disparities may be most obvious and of greatest concern. Here, many rural groups have yet to step on even the first rung of industrialization, and the poor in some of the world's largest and most congested cities are eking out a living at best. These people continue to live at a subsistence level, or in some cases below it. Access to education is marginal or nonexistent, jobs are not available, and direct economic support is infrequent or absent. As the workforce shifts up the skill ladder, these groups become increasingly unlikely to benefit from any economic successes which may be developed and enjoyed at the personal level. Their only opportunities are likely to arise from direct government support, programming that is often too little and too late, and a route that does not typically generate self-sufficiency.

A second layer, those who through innovative programs, perseverance or mere happenstance have managed to get to the first rung of employment, are those most likely to fall off the ladder as the workforce is compelled to adjust to a changing and increasingly skilled work environment. If permitted to happen, there is the potential to lose much of the development success that has been gained in the last three decades. In this context, women as well as ethnic minorities may be the first to fall off the ladder given an environment without commitment and innovative policies and programs that ensure these groups do not become re-marginalized.

The third group at risk include those who are currently employed, but in job areas where the skills are such that developmental opportunities are unlikely to be generated. This can occur for a number of reasons. For example, skilled workers in industries where the entire workforce is outdated are unlikely candidates for re-training. Similarly, older workers and those who are less flexible, such as workers who have social and cultural ties with extended families, are also less likely to be targeted for re-training opportunities. Although this may benefit young, single workers, the overall effect on the society can be extraordinarily problematic. In a similar vein, the shift in labour markets from "blue collar" to "white collar" workers presents analogous issues. Blue collar workers when compared with white collar workers are, quite simply, less likely to be seen as candidates for up-skilling and re-training.

For many APEC members there is also the continual threat of much needed expertise leaving the economy. This is prompted by supply and demand differentials

which are related to varying growth rates in different parts of the economy. Economies intent on ensuring a smooth transition to lifelong learning need to address this issue, likely through carefully thought out policy initiatives.

Ideally, an effective learning environment will address the imbalance in terms of learning needs as these exist within different strata and communities. The goal must be an inclusive learning society where there are opportunities and hope for all. Without this inclusiveness there will be ongoing instabilities and significant risk for economic losses. Parallels can and are being drawn at the regional level. As a result, the need for APEC and other organizations to share development perspectives and resources is critical.

STRATEGIES FOR THE ROAD AHEAD

The road to lifelong learning, workforce development and economic success is one and the same, but there are many different paths. Though it is difficult to imagine a society in the 21st century enjoying the benefits of economic growth without a comprehensive, inclusive system of lifelong learning, it is also clear that APEC member economies will achieve this in different ways. There do appear, however, to be several key tools or strategies that are proving to be successful for the development of lifelong learning, a competitive workforce and economic success across the region.

Partnership and Participation

The establishment of partnerships between government, business, and learning institutions appears to be fundamental to the development of planned infrastructure and programming in support of lifelong learning. The examples in Singapore, Chinese Taipei, Malaysia and Canada, detailed earlier in this paper, support the premise that public and private sector partnerships, as well as partnerships solely within the private sector, provide the synergy and complementarity required to develop innovative, large scale technical solutions and opportunities. Clearly, whatever government can do to benefit the development and growth of partnerships in education and learning will benefit the development of effective systems. As well as bringing different expertise to the task, partnerships, more importantly, break down artificial barriers between disciplines.

Technology as a Tool

The use of technology, and information technology in particular, is a critical tool for the development of lifelong learning opportunities. Traditional approaches to learning, particularly those which are teacher-centred and institution-driven, are not going to meet the training, re-training and personal development needs of the 21st century. The scale of learning needs for the 21st century is going to drive the development of applied educational technology.

An analogy may be drawn with the development of computer systems. From the late 1940s to the early 1980s, a period of 35 years, computer technology was impressive in so far as its ability to deal with specific tasks, most of those large in scale and of a routine nature. But day-to-day life was not obviously and immediately affected

by this technology. Now, with the advent of the personal computer, the real revolution in computer technology has begun. With education and learning it may be the same. Large educational institutions are now attempting to harness the power and applications associated with various technologies including the Internet and World Wide Web, and to a certain extent some have accomplished this, albeit in a coarse manner. However, the effect on the general population remains limited. When the technology associated with learning infiltrates everyone's workplace and home, the real revolution will have begun.

Infrastructure versus Programming

There is a need for both infrastructure development and for operative programming in order to optimize the development of lifelong learning systems. The comparison is nicely illustrated by comparing two companies, one which always implemented ideas in the first month and then spent the next two years developing the infrastructure, fine tuning and correcting the problems, while the other always spent two years developing structure and preparing for the opportunity followed by a one month implementation. In the first instance the tendency for error is extreme and costly. In the second example the market opportunities are lost and the environment so radically changed that the plan is outdated before it is implemented. Infrastructure development must be combined with operational programming in order to take advantage of the combined opportunities afforded by a sound platform alongside practical experience and feedback.

Concluding Comment

The development of a skilled human resource base is critical, a necessary tool for economic success in the next century. Building capacity, partnerships and a learning society is a goal common to all APEC members. Effective use of technology will ensure that success.

> *In the new global economy, where knowledge is the key resource, the quality of a nation's human resources is critical to ensuring competitiveness. ... The key to prosperity in the knowledge economy is for workers to make intelligent use of information. Learning must span all our working lives. Technology will make that possible.*
>
> (Information Highway Advisory Council, 1996)

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